

BUILDING COMMISSIONING

for better public buildings

CASE STUDY

CLOVER PARK ELEMENTARY SCHOOLS — RETRO-COMMISSIONING REAPS REWARDS



Oakbrook Elementary School

Because of their higher-than-average energy costs, four schools in the Clover Park School District were selected for retro-commissioning in 2002. This case study focuses on two of the projects—Idlewild and Oakbrook Elementary Schools.

The purpose of the retro-commissioning was to identify and implement low- and no-cost energy savings opportunities, and to pilot test the concept of using the energy savings to fund the needed repairs. Savings were initially projected to be approximately 15% of baseline energy costs.

Abacus Engineered Systems, Inc. was selected to perform the retro-commissioning. Funding was provided by the Washington State Treasurer's "LOCAL" program, the Washington State Department of General Administration's building commissioning program, and Puget Sound Energy.

COMMISSIONING QUICK FACTS

Building Name	Idlewild Elementary	Oakbrook Elementary
Location	Lakewood WA	Lakewood WA
Project	Retro-commissioning	Retro-commissioning
Commissioning Scope	Energy saving measures related to HVAC systems and controls	Energy saving measures related to HVAC systems and controls
Building Size	46,187 sq.ft.	49,218 sq.ft.
Total Commissioning Cost	\$37,550	\$37,550
Commissioning Cost per Square Foot	\$0.81	\$0.76
First-Year Cost Benefit	\$8,600	\$9,200
Annual Energy Savings	\$6,600 per year	\$7,000 per year

PROJECT PARTNERS

**Washington State
Department of General
Administration**
Roger Wigfield, P.E.

Clover Park School District
Vic Espinosa and Pete
Munoz

**Abacus Engineered
Systems, Inc.**
(Commissioning Agent)
Mark Bowman

**Siemens Building
Technologies**
(Energy Management
Control Systems)
Don Hoopengartner

“Retro-Commissioning in a performance contracting environment limits corrections to energy savings measures that have desirable payback periods and does not fix everything wrong in an HVAC system...it requires building owners to be realistic in assessing their determination to maintain the facility during the payback period to the level of fitness achieved by doing Retro-Commissioning. Otherwise, Retro-Commissioning should not be included in performance contracting.”

Vic Espinoza
Maintenance Planner
Clover Park School District

PROJECT SCOPE OF WORK

The project analyzed and implemented modifications to the following systems:

Idlewild Elementary

- Central hot water heating system with two boilers
- 20 unit ventilators, 4 heating and ventilating (H&V) units
- Direct digital control system

Oakbrook Elementary

- 36 air-to-air heat pumps with electric resistance backup heat
- Direct digital control system

Because the school district has its own indoor air quality program, the project specifically excluded measurement and adjustment of ventilation air quantities.

ISSUES IDENTIFIED

Idlewild Elementary

- *Boiler plant:* Field inspection identified a problem with pressure relief valves—water was regularly being blown off during start-up. To correct over-pressurization, make-up water systems were adjusted. The project also corrected lead/lag boiler sequencing and hot water supply temperature controls.
- *After-hours operation:* The sequence of operation for unoccupied heating was revised to first use the hydronic baseboard radiator rather than the less efficient unit ventilators. Idlewild also had the same override switch issue as Oakbrook Elementary (see description below).
- *Hydronic baseboards:* Three uncontrolled radiators in entry vestibules could easily be fitted with a thermostatic control valve.

Oakbrook Elementary

- *Electric resistance backup:* Decided to disable backup heat for 9 of the 36 heat pumps whenever outdoor temperatures are above 45°F (the others are set for 50°F). This control scheme will be tested for one year.
- *After-hours operation:* Override switches used after regular school hours were operating the heating and ventilation longer—and with more outside air—than necessary for the typical 3 or fewer occupants. Thus, the controls were re-programmed.

Both Schools

- Nearly 80% of the electronic thermostats were out of calibration by 1-3 degrees. In addition to calibrating the thermostats, their setpoints were modified to save energy.
- 27 mixed air damper actuators were observed to either not track or stroke properly, or to be stuck open.

ENERGY IMPLICATIONS OF COMMISSIONING

During the 4-month period after retro-commissioning, energy savings were calculated to be \$3,303—a savings of approximately 10%—well short of the expected 15%. To investigate this shortfall, the commissioning agent surveyed the school principals and district staff, reviewed control system settings, and installed power logging equipment at Oakbrook. Several variations from the baseline year may have contributed to the lower-than-expected savings, e.g.:

- One additional classroom was used at Idlewild, and a new refrigerator was added.
- Occupied heating setpoints had been increased by 1°F at Oakbrook.
- The school district had not yet retrofitted the three vestibule hydronic radiators with control valves.
- The outdoor temperature sensor for the control system failed during the coldest winter months and was over-ridden by district staff, disabling the lockout of electric resistance heating.

By taking steps to follow up on the system's performance, investigate potential opportunities to reduce peak demand at Oakbrook, and work with school district staff, the commissioning agent is hopeful that additional saving strategies will be implemented.

ADDITIONAL BENEFITS

Retro-commissioning provided an opportunity to verify, correct, and document operation of mechanical equipment and controls. For example:

- Electronic thermostats were calibrated against a reference standard.
- Space temperature setpoints were reprogrammed according to school district policy.
- Building-level controls were programmed for regular, holiday, and half-day schedules for the next two school years.
- The commissioning agent created an issues list for the school district. The list documents the energy saving opportunities he identified, as well as mechanical problems and other issues observed during the project.

PROJECT BENEFITS

- \$17,800 in first-year cost benefits (such as reduced energy consumption, improved indoor air quality, improved occupant comfort, etc.)
- \$13,600 in annual energy savings
- Identified and documented equipment and operational issues
- Pilot tested the concept of using energy savings to fund projects at additional schools
- Initiated investigation of potential peak demand savings

"The project was an effective overall solution to save energy dollars and do some upgrades at the same time. It was a smooth process where concerns were addressed and there was no impact on occupants."

Pete Munoz
Supervisor of Maintenance
Clover Park School District



Commissioning agent identifying boiler problems at Idlewild Elementary School

FOR INFORMATION ON WASHINGTON'S COMMISSIONING PROGRAM



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WHAT IS COMMISSIONING?

Building commissioning is a systematic and documented process of ensuring that building systems perform according to the design intent and the owner's operational needs.

Commissioning is used in both new construction and existing buildings.

Commissioning:

- Provides a better environment for occupants
- Reduces indoor air quality problems
- Reduces occupant complaints
- Reduces contractor call-backs and warranty issues
- Reduces energy consumption and operational costs

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